FRESH-WATER SPONGE.

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[PLATE IV., FIGS. 2 AND 3.]

The anomalous character of sponges, whether marine or fresh-water, rendered it difficult, in the early study of the subject, to determine whether they belonged to the animal or vegetable kingdom. At length pronounced animal by Dr. Grant, Carter, and others, it then became difficult to find their *taxonomic* place in the scale of animals. This, we think, was determined in 1867 by H. James Clark, and afterwards corroborated by the researches of W. Saville Kent. Both of these place them among the *Protozoa.* In the fresh-water sponge there was an element not found in the marine, whose nature and offices were as difficult to define as any other characteristic of sponge life. I have reference to the *globuli*, or seed-like bodies which we now call statoblasts, or statospheres. The names by which these bodies have been known, and the offices assigned to them by naturalists at different times, have had a share in befogging the subject, and in hindering the proper study and classification of the forms which have been known to exist for many years. In consideration of the growing interest manifested in the study of fresh-water sponges in Europe, and the wide distribution and varieties now known to exist in this country, and, I might add, in view of the fact that few microscopists have given the subject any thought, I may be pardoned for giving a hasty glance at the steps by which our present knowledge and classification have been reached. In doing this, I gather a few facts, mostly from Mr. Carter's paper on

the known species of *Spongilla*, published in the *Annals and Magazine of Natural History* for February, 1881.

In 1745 Linnæus described two species of fresh-water sponge under the names, respectively, *Spongia lacustris* and *S. fluviatilis.* Subsequently, in 1816, Lamark instituted the word *Spongilla* for the genus, whereby we now have *Spongilla lacustris* and *S. fluviatilis.* In 1837 Meyen pointed out that the crust of the seed-like bodies,—now statoblasts,—was made up of vertically-placed spicula, at whose extremities little toothed discs were formed. These we recognize as the birotulates. He also stated his belief that the seed-like bodies are similar to what are denominated the winter eggs of the Polyzoa. In 1859 Mr. Carter published a work on the identity of the so-called seed-like body of *Spongilla,* with the winter egg of the Bryozoa, and finally adopted the term *Statoblasts* for these bodies, by which term they will undoubtedly be henceforth known. In 1840 Mr. John Hogg demonstrated beyond a question that the seed-like bodies germinated in water, and thus produced *Spongilla.* In 1842 Johnson published his great work on British sponges, from which the Monograph of Bowerbank is chiefly compiled. In 1856 Lieberkuhn published his work on the "ovum" of *Spongilla.* In 1867 H. James Clark established, beyond doubt, the animality of *Spongilla,* together with the form of the animal itself, for which, in 1872, Mr. Carter proposed the name *Spongozoön.* In 1875 the same writer laid the basis of a classification which he extended and confirmed in the Monograph from which I gather these data. The classification is based chiefly on the spicula of the statoblasts, and is, perhaps, the best that can be offered, although it may be too narrow to admit all the forms known at this time, as the sequel of this article will show. It is quite within the range of possibilities that other species than those already known may be found, having peculiarities quite independent of spicula or statoblasts. Every month demonstrates that fresh-water sponges have a wider geographical range than was formerly thought of, and new species are being found in nearly or quite all the gently-running brooks and rivers, and in the lakes throughout the country.

In perfecting his plan of classification in 1875, Mr. Carter says he found it necessary to make the fresh-water sponges the fifth

family of his sixth order of the *Spongida* generally under the name of *Potamospongida*, with a single group at present named *Spongillina*. Hence, so far they will stand thus:

Order VI. HOLORHAPHIDOTA.

Char.: Possessing a skeleton whose fiber is entirely composed of proper spicules, bound together by a minimum of sarcode. Form of spicule variable.

Family 5. POTAMOSPONGIDA.

Fresh-water sponges.

Group 19. *Spongillina*.

Char.: bearing seed-like reproductive organs called statoblasts. He then divided the known species into five *Genera*, each genus characterized by some peculiarity of the form or position of the spicula of the statoblasts.

Genera: first—*Spongilla;* second—*Meyenia;* third—*Tubella;* fourth—*Parmula;* fifth—*Uruguaya.*

SPONGILLA.

General character. Statoblasts globular, charged with minute acerates which are smooth or spined, according to the species, arranged tangentially.

To this genus belong two species found in Niagara River, heretofore, and now according to this classification, called *Spongilla fragilis* and *S. Ottawaensis.* The former species was so named by Prof. Leidy, and is similar to, if not identical with, a species now in the British Museum, and named by Bowerbank *S. Lordii.* This sponge is sessile, encrusting stones and pieces of wood and weeds. Structure fragile, crumbling, so much so that where there is a dashing of waves, as on the banks of the river, most of the skeleton is washed away, leaving in many cases the statoblasts in a bare continuous layer. Statoblasts flattened spheroid. Mr. Carter says they are flat, bottle-shaped. Aperature of statoblasts prolonged slightly from the summit by a short, tubular extension; spicula of statoblasts slightly curved, small, spined, rounded at the ends, arranged tangentially on the statoblast. The other species referred to, *S.*

Ottawaensis, from having been found in the Ottawa River by Mr. G. M. Dawson of Montreal, has the form of the spicula, and their arrangement on the statoblasts very similar to those of *S. fragilis*, but there is one difference of a marked character. The statoblasts of this species are not in a continuous layer, but are free, and grouped in twos, threes and fours. They are held together firmly by the same granular substance that forms the crust of the entire statoblast. The short chitinous tube is bent around similarly to the air tube of a steamship, though not enlarged in the same way at the end. (Plate IV., fig. 2.)

Both of these species are infested with almost innumerable enemies, which devour the sarcode and other living portions of the sponge so that the best specimens found hitherto in Buffalo have been but fragmentary. In most species of the *Spongilla* the wall of the statoblast is comparatively thin, composed of a granular substance lined with the chitinous coat. In some species, however, there is a crust of polyhedral cells, which in section are hexagonal and arranged perpendicularly to the outside wall of the statoblast. Of such are *Spongilla Carteri*, found in Bombay, India, and *S. nitens*, both described by Mr. Carter, and a specimen found in a creek in Hamburg, N. Y., twelve miles south of Buffalo, by Mr. E. S. Nott.

MEYENIA.

This genus is named after Meyen, who first discovered the birotulates, and is made to include all sponges, the walls of whose statoblasts are made up of birotulate spicula placed radially, one end resting on the chitinous coat and the other extending to the outside surface. The heads of the birotulates are denticulated, and present more or less of a stellate form; or they may be flat or umbonate discs. The first sponge found in Niagara River, by Prof. Kellicott, belongs to this genus. Mr. G. M. Dawson had found the same species in Canada, and named it *Spongilla asperrima*, but according to our present classification it must be *Meyenia asperrima*. It differs very slightly, if at all, from *Meyenia fluviatilis*.

In November, 1881, I found one specimen of a species resembling this in many particulars, but differing so as to suggest another

species. Further investigation and comparison is needed before definite results can be obtained.

TUBELLA.

Tubella means a little straight trumpet. The spicula of the statoblasts of this genus are unequal birotulates. In Mr. Carter's own words, "The spicula are little trumpet-shaped spicula, having a straight shaft which is smooth, spined or inflated, or both, terminated by a large disc at one end and a small one at the other." No species of this genus has been found as yet around Buffalo.

PARMULA.

Parmula, a little round shield. The statoblasts of this genus are globular, large, crust composed of granular micro-cellsubstance charged with and surrounded by minute acerate spicula, and limited by a layer of parmuliform, or shield-like spicula.

URUGUAYA.

This genus is only formed provisionally. The single species which has suggested it was found in the Uruguay River, and was altogether without statoblasts. The name given it by Bowerbank is *S. corallioides*. Carter names it *Uruguaya corallioides*. I have little doubt but that the statoblast will be found by some student of South American sponges.*

I have given this short synopsis of Mr. Carter's classification, and endorse it fully, so far as it goes. But, from discoveries made in this country by Mr. Potts of Philadelphia, and Prof. Kellicott and myself in Buffalo, at the very time that Mr. Carter was perfecting his plan, it seems already too limited and narrow for all the species found.

In October of 1879, Prof. Kellicott found a specimen of a sponge in Niagara River, having prolonged tubes and finger-like processes attached to the statoblasts. [Plate IV., fig. 3 (diagramatic).]

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* Since this article was written, the *American Monthly Microscopical Journal* has published a short article on Fresh-water Sponges and their Classification, by my friend, Mr. E. Potts, of Philadelphia, which differs a little from Mr. Carter's. In October, of last year, Mr. Potts discovered a new species which he has named *Heteromeyenia Ryderii*, and upon which he proposes to establish a new genus to be called *Heteromeyenia*. The statoblast of this species has two series of spicula, each equal ended, but of unequal length. The shorter series resemble those of Meyenia, while the longer and less numerous series are terminated by recurved hooks, and are generally spined. The proximal ends of both series rest on the chitinous coat. This genus takes the place of Carter's Uruguaya, the generic character of which is doubtful.

The appearance of these was very unique, and there was no description of anything like it in sponge literature. He kindly handed this specimen to me, requesting me to work it up and see whether it was really new. Accordingly, I sent the specimen to several, among whom was Mr. Potts, of Philadelphia, who, strangely enough, had just discovered a species differing in many points from ours, but having tubular and cirrous processes, even longer and more marked than ours. In a few days or weeks afterwards, the same gentleman found another species, differing widely from the others, but having the same family likeness. Thus we had three new species unlike anything ever seen before, either in Europe or America, and which justified the establishing of a new genus. The name *Carterella* was proposed by Mr. Potts, out of compliment to Mr. Carter, who has written so much and studied so thoroughly all the known forms of fresh-water sponge. Specimens of all three species were sent to him for his examination, and approval of the new genus. From what follows it will be seen that he was not prepared for so uncommon a sight in sponge growth. Having discovered a parasite on a marine sponge, *Hircinæ communis*, in 1878, which he called *Spongiophaga communis*, he at once pronounced the cirrous growths on all three species to be of the same parasitic character. He pronounced that two, at least, of our three sponges were not new species, but were *Meyenia Baileyi*, infested with a parasite that would ultimately kill them, as the *Spongiophaga communis* kills the marine sponge upon which it is found. The statement of his theory is published in full in the *Annals and Magazine of Natural History* for November, 1881.

As might have been expected, the microscopists on this side of the water who had studied all the forms, from the discovery of the first fragment, would not listen to any such idea, for reasons which were set forth in much correspondence on the subject, but which it is now unnecessary further to refer to. It is highly gratifying to know that Mr. Carter has proved himself too great a man long to hold to a theory so unwarranted. In the *Annals and Magazine of Natural History* for May of this year he writes another article, making full retraction of his former statement, and says it was based on entirely unsound premises. Therefore, we say, if the theory of the

parasite was based on false premises, the rejection of these new species falls to the ground, and they must stand, and henceforth be known as

Genus 6, Carterella.

General character: Prolonged foraminal tubes and cirrous appendages to statoblasts. Location: Niagara River, Fairmount Park, Philadelphia, and the water-supply of Indianapolis. The names of the sponges in this genus are *Carterella tubisperma*, *C. tenosperma*, *C. latitenta.*

It is frequently asked where sponges may be found, and what is their appearance in their natural growing state. They may be found in almost every gently-running brook, rivulet or still, perennial water; but from the nature of their re-productive bodies they do not grow in swiftly-running streams, except on the under side of stones and other hard substances. I have found them growing on the stony bottom of a very shallow place in Niagara River where there was no current; and in a still bay on the margin of the river a great many pieces were found attached to ordinary weeds. Sponges may sometimes be found attached to the fibrous roots of trees or grasses growing on the banks of a river or pond, and sending their roots into the water. In cities whose water is received through an inlet pier, friendly relations should be established between the microscopist and the men who have charge of the wire screen of the affluent gates at the pier, for in the autumn and early winter the sponges are set free, and following the strongest current, are caught by the screen. In this way we might obtain species whose habitat is in deep water, and unapproachable from the shore. It is by the lodgment of sponges on the screen in this way that we are able to account for the presence of spicula in our water-supplies.

The statement that fresh-water sponge consists of a mass of clear, homogeneous, jelly-like matter, is incorrect, and calculated to mislead and confuse the searcher for natural objects. It is true the skeletons of all fresh-water sponges are held together by a sort of gelatinous mass of sarcode or cytoblastema, but in most cases the spicula seem to precede the sarcode in growth, so that they stand out like tent-poles, as one has said, protruding through the dermal covering of the sponge, giving the specimen a fibrous appearance.

Besides, in all the specimens that I have examined, the spicula which form the skeleton are packed in so closely that no form of jelly can be seen, except by the microscope. I wish to make this plain, because some have been led to search for masses of jelly when desiring to find sponge. To one who wrote me to know where he should look for the jelly-mass, I replied: "If you wish to find sponge, cease looking for jelly." Some of the specimens which I found in Niagara River last October were hardly to be distinguished at a little distance from fine Turkey sponge. Of course the difference would be apparent upon handling, because the sarcode is not strong enough to keep the skeleton together. Our *Carterella tubisperma* is generally green or greenish, and of rather loose texture. The green coloring-matter appears to be a minute alga taken up by the sarcode, so as to be mistaken by some for a part of it.

In closing this short and incomplete article, I wish to remark that I believe there are few objects in nature that afford the scientific investigator a wider field for work than the sponges, marine or fresh-water. Whether we look into their structure, their mode of growth, their geographical distribution, or the uses they have subserved in the building up of some of the most interesting strata of the earth's structure, they afford ample scope for deep and pleasurable investigation.

EXPLANATION OF PLATE IV.

Fig. 1. *a, Rhizosolenia Eriensis*, H. L. S.
b, b', Rhizosolenia gracilis, H. L. S.

Fig. 2. Statosphere of *Spongilla Ottawaensis*, Dawson, containing three (a) statoblasts: t, t, t, foramenal openings with short bent tubes turned upward.

Fig. 3. Diagrammatic representation of statoblast of *Carterella tubisperma*, Mills: *c*, globular statoblast surrounded with birotulate spicula, one end of which rests on the chitinous coat *a; b*, tube of statoblast, which is a continuation of the chitinous coat: *d*, cirrous processes at the end of tube, not accurately drawn for any species. Other species referred to in the text as *Carterella tenosperma* and *C. latitenta* of Mr. Potts have shorter tubes, but with processes very much longer. *C. latitenta* has processes *wide* and *ribbon-like*, near the connection with the short tube.

Fig. 4. Statoblast of *Plumatella orbisperma*, D. S. K. *a*, annulus; *b*, ciliate body moving about the cavity; *c*, a small one also ciliate.

Fig. 5. Statoblast of *Pectinatella magnifica*, Leidy, with the hooks pushing up the gelatinous covering, showing cilia at *c; a*, annulus; *s*, horny sheath.

Fig. 6. Statoblast of *Cristatella ophidioidea*, Hyatt, before the spines appeared, surrounded by a ciliated membrane; *c*, cilia well seen at the edge.

PLATE IV.

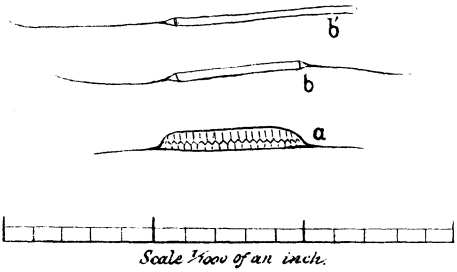

Fig. 1.

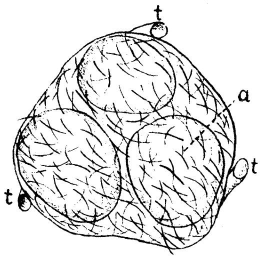

Fig. 2. × 52.

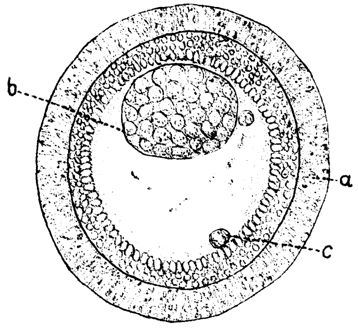

Fig. 4. × 116.

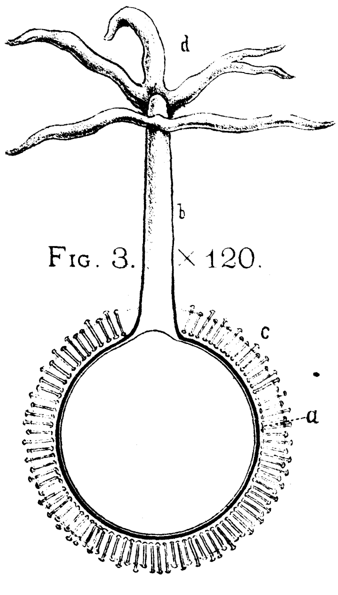

Fig. 3. × 120.

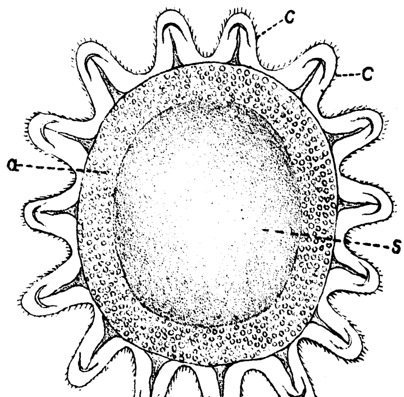

Fig. 5. × 38.

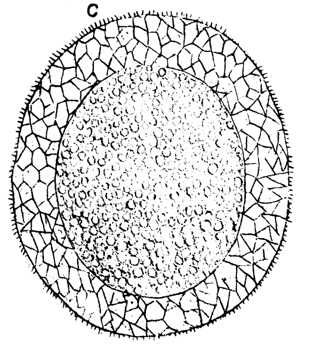

Fig. 6. × 38.